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THE GOVERNMENT OF AMERICAN UNIVERSITIES

THERE are perhaps some advantages in discussing the question of university government during the summer vacation, when partial detachment from professional duties makes possible a clearer perspective than when one is in the thick of the work. The problem is both difficult and urgent, and in approaching it one can not do better than remind oneself of the need of patience and good feeling in its consideration. Above all, it should be emphasized, as has already been done by Professor Jastrow in a recent number of SCIENCE, that the attack is not directed against individuals, but against a system. That system may be described as one of personal government, as opposed to government by consent or the self-government of a freely acting community. The objections against this system are directed not merely against the exercise of irresponsible power by college presidents, but against all claims on the part of any member of the university body to subject another to his personal will.

The urgent character of the problem, and the consequent significance attaching to the present agitation for reform in university government, is due to the fact that the very idea of a university as the home of independent scholars has been obscured by the present system. If it were true that only a few supersensitive individuals among university teachers were affected in their personal feeling by the power now exercised by presidents and other university administrative officers, the question would have little significance. But

it seems clear that there exists a large class of university teachers to whom it is every year becoming clearer that they have neither part nor lot in the larger interests of the institution to which they are attached. The effect of this condition is different in the case of different individuals. Some pessimistically give their assent to the theory that a university teacher is simply an employee of the trustees, who is paid a fixed salary for teaching certain classes. Others, having a truer sense of the importance and dignity of their profession, yet recognizing that the logic of actual events confirms the theory which they deny, grow restive and generally find the cause of their discontent in the tyranny of some individual whom they believe to be depriving them of their just rights. In both cases alike the result is unfortunate, and one that loudly calls for remedy. A man who regards himself as merely an employee is not likely to give to the university more than his theory demands, while a man who lives with a constant sense of grievance, knowing that there is no court before which he can claim redress, can not reasonably be expected to be greatly in love with his profession.

It is clear that the problem can not be solved by giving to each individual exactly the same weight in the government of the university. Organization and efficiency demand that some individuals shall have more responsibility and some less. But it is essential that each university teacher shall be conscious that he is a member of a community with which his own interests are organically bound up. This is only possible when the individual is made to feel that he is governed by principles to which his own reason consents. It seems unnecessary to argue that where this feeling is absent some change is imperatively demanded. As Mr. Balfour is reported to have said in a recent speech in parliament: "Whenever you get to the point that a class feels itself excluded, and outraged by being excluded, then those who believe that democracy, properly understood, is the only possible government for any nation at the stage of political evolution which we have reached, must consider whether it is not their business to try to see that the government which is by hypothesis not a government by consent, can be turned into government by consent." The truth seems to be that in the era of expansion through which we have been passing we have been concerned with problems of material and organization, and have had no time to develop that internal spirit of loyalty and community without which bricks and mortar, overflowing class rooms, and even learned teachers and investigators can not make a real university. In the universities as elsewhere, the era of expansion has been attended by a certain loss of the ancient freedom. The demand has been for men "who could do things," and the tendency has been to measure efficiency in terms of immediate and striking results. Now, however, there seems to have come a period of reflection, and we realize that the spirit of a university can only spring from a free soil, and flourish in an atmosphere of fraternity.

The working theory as to the division of authority between the faculty and trustees has been that to the former belongs jurisdiction over all educational matters, while the latter have the right of control over all questions involving expenditure of money. Now, this enunciation of the respective powers of the two bodies has proved the bulwark of our liberties, and has served to prevent the direct interference of the trustees with the work of teaching. The talk of applying "business methods" to the administration of the university is still

occasionally heard in certain quarters, but the right of the faculty to control the educational policies, is now generally conceded by the trustees of all the more important universities. And it would not be fair to forget the important work that the presidents have done to secure this result, in upholding the rights of the faculties against boards of trustees, and in preventing these bodies from meddling in educational matters.

Nevertheless, it seems evident that university faculties have not yet fully realized all that their responsibility for educational work implies. In the first place, it is clear that this power can only extend a little way, unless it includes a voice in determining how the funds of the university are to be applied. Educational questions, and questions regarding the proper expenditure of money, can not be dissociated, and, as a matter of fact, the apportionment of funds among the different colleges and departments of a university is not now controlled by the trustees, but is, largely at least, determined by the president. The same is true of appointments to membership in the faculty and of promotions. It can not be denied, I think, that control on the part of the faculty of educational interests involves and requires a voice in determining the character of its own membership and in electing its own officers, including its president. This is the right and privilege of every self-governing body, and it is only under these conditions that a faculty can develop that sense of unity and *esprit de corps* which is essential for the most effective discharge of its functions. At present, however, this power which is nominally in the hands of the trustees is usually exercised by the president. The truth, then, seems to be that at least two important matters, which are vitally connected with the educational work of the university, are in many of the universities assumed by the president, and exercised by him without any official recognition of the faculty. In practise it is doubtless true that the president is influenced, both in his recommendations as to the expenditure of money, and in his nominations for positions in the faculty, by the opinions and advice of certain members of the faculty, particularly of deans and directors and heads of departments. But neither the faculty as a whole, nor any individual member, can claim an official right to be heard or to have a vote in such matters. The result is unquestionably unfortunate, for both the president and the faculty. On the one hand, as the president has assumed sole responsibility, and as there is no body before which he comes to explain the grounds for his decisions, he becomes the target for criticism, which, unfortunately, often fails to understand the real conditions of the case. He thus suffers the loss of that sympathy and support which rightly belong to him in the discharge of his difficult duties. This, as wise presidents know, is a great source of weakness. "Bare is the back," says the Gaelic proverb, "without brother behind it."

There is also another side to the matter which can not be ignored: a system that does not leave room for freedom affects injuriously the ruler as well as the ruled. The psychological effects of irresponsible power upon the mind and character of those who exercise it has always been a favorite theme in literature. I have no wish to dwell on this side of the subject, but it can not be forgotten that a rational and moral life is only possible where there is a reciprocal "give and take" process with one's fellows. The man who isolates himself, thinking that he has the source of authority within himself, pays the penalty, as necessarily and inevitably as if he had

cut himself off from the sustaining life of the physical atmosphere.

The unfortunate effect of the present system upon university teachers has been already referred to, yet this point is so important as to demand frank discussion from many sides. I hope that the question will be taken up by others, and that we may be able to look the present situation squarely in the face. It seems fair to ask whether the present system of government, whose boast is in its efficiency, has tended to dignify the professorial office by giving to the men who hold it the strength and stimulus that comes from a consciousness of membership in a community devoted to the highest ends. Is it likely to attract into the profession men of independent spirit and to call out the best that is in them? The actual state of affairs it seems to me, compels us to answer questions of this kind in the negative.

In spite of the fact that the office of university president has been filled during this generation with gentlemen who have as a class attempted to discharge its duties, not only with fairness and integrity, but in a spirit of patience and consideration for the rights of others, no one can doubt that the system has had its day, and that a change is at hand. It is an anachronism in this modern age, and an anomaly in a democratic country. The arbitrary power of the president has always been a subject of wonder to European scholars. Professor Alois Brandl, of the University of Berlin, gives the following picture of the American university president,[1] which is fairly typical of the impressions our visitors carry away regarding that office:

> Er muss ein "starker Mann" sein, a strong man, der das Blühen und Wachsen der Anstalt in jeder Hinsicht betreibt. Verantwortlich ist er nur den Vertrauensmännern. Wird er bei diesen verklagt, so müssen diese sagen können: "Was wollt ihr? Er ist ein starker Mann, wir bekommen keinen bessern, wir halten zu ihm." Hat er diese Rückendeckung, so ist er fast unbeschränkter Herr über den Lehrkörper und kann Absetzungen wie Anstellungen mit einer Freiheit vornehmen, wie sie bei uns kein Minister geniesst, kein Monarch gebraucht. Durch solche Einrichtung von Diktatoren liebt es bekanntlich der Amerikaner, gegen die Ungebundenheit seiner Verfassung ein Gegengewicht zu schaffen, um eine wirksame Verwaltung zu ermöglichen. . . . Dagegen findet die Macht des Präsidenten ihre Grenze an der Bodenschicht der Universität, an den Studierenden. Gegen diese übt er in der Regel das freundlichste Entgegenkommen; denn eine starke Auswanderung der Hörer, selbst ein häufiges Durchfallen bei den Prüfungen würde auf das Gedeihen der Anstalt einen Schatten werfen und wird daher nach Kräften vermieden. Durch den Präsidenten hat der Studierende in Amerika eine Hand auf den Dozenten, wie bei uns durch das Kollegiengeld: so greifen dort die innersten Räder ineinander. Der Kurator an einer preussischen Provinzuniversität, den man am ehesten mit dem "president" in Parallele stellen möchte, hat ein wesentlich verschiedenes Amt; er hat weniger zu sagen, aber auch weniger zu sorgen; er ist ungleich abhängiger nach oben und unabhängiger nach unten; er ist nur ein respektirter Vermittler und nicht ein autoritativer Führer.

I have said that the present relation between the university presidents and the faculties must undergo a change in the interests of both parties. I can not, however, think that it would be a step in the right direction for the faculties to appeal, as Professor Jastrow suggests, to the lay members of boards of trustees against the presidents. For, after all, it must not be forgotten that the presidents belong to the faculty side of the family. As President Butler has said: "The heads of the great universities were every one of them not long ago humble and poorly-compensated teachers."[2] If a breach exists between president and faculty, it should rather be closed than widened. In other words, what requires to be emphasized is, not the rights

[1] *Deutsche Rundschau*, April, 1907.

[2] *The American as He Is*, p. 38.

of the professors as over against those of the president, but the duties and responsibilities that belong to all in virtue of their membership in the common corporate life of the university. As has been frequently remarked, "liberty" and "equality" are one-sided and inadequate ideas until they are completed by the conception of "fraternity." And within this idea of fraternity the president, as well as all other members, should be included. He is not to be regarded as an *Uebermensch,* standing in special relations to the Absolute, or, on the other hand, as lacking in the virtues and loyal feelings of his colleagues. He is a man and a brother on whom great responsibilities rest. But he has received no new baptism which should set him apart from his fellows. The burdens and responsibilities he carries are shared by his colleagues, who gladly yield to him the honorable position of *Primus inter pares,* because he is, to a greater extent than any other member of the faculty, the servant of all, and because they recognize also that in him is embodied and personified the corporate authority and dignity of the university more fully than in the person of any other member. When these relations are realized the strength of the president's position is greatly enhanced and dignified, because it is *inclusive* and represents the authority of a self-governing faculty. In universities, as in all social organizations, absolute power is the weakest form of authority, because it is exclusive and disintegrating. In denying the rights of others, it establishes a system of potential war, where there is no law but the will of the strongest. On the other hand, real authority only exists in so far as it is shared by others. Its impregnable rock of support is found in the fact that it expresses the will and consent of the governed.

These principles are, of course, very old, but they never become trite. They seem to furnish the only practical solution of the problem of university government. For they make clear the hopeful line of advance. Faculties must rise to a realization of what is involved in their responsibility for educational affairs. "It devolves upon the faculties," says President Eliot in his book on "University Administration," ". . . to discern, recommend, and carry out the educational policies of the institution." Let us take our stand upon this, and proceed to act without stopping to debate constitutional questions. *Hic Rhodus, hic salta.* By accepting their responsibilities, the faculties will regain their rightful authority. "The way to resume is to resume." It is not by any great external revolution in the form of university organization that the system is to be changed, but by gradual evolution from within through a movement from which we may hope that "freedom will slowly broaden down from precedent to precedent."

If objection be brought to this program on the ground that it is unpractical—an objection that is often mistaken for the voice of an oracle—I would reply that it is only necessary to lift up one's eyes to see that the program is already in course of fulfilment. The very fact that the subject is being discussed shows that a change has come: ten years ago the importance of the problem was realized by scarcely any one. Studies like that of Professor Marx, on "The Problem of the Assistant Professor" have emphasized the need of more freedom and democracy in the organization of faculties. President Hill of the University of Missouri, in reply to one of Professor Marx's questions, writes: "A more democratic organization of department faculties seems to me one of the most important and pressing reforms demanded in educational institutions." President Hill was thinking

only of democracy within a department; but it is obvious that there is a demand for a wider application of the principle. At Yale, and also at some of the smaller universities, the faculty has an official voice in determining the character of its own membership. At Cornell University the faculty of the college of arts and sciences have more than once in recent years made recommendations which were accepted by the trustees regarding the establishment of new chairs in that college. And during the last year the faculty of the graduate school at Cornell adopted an important series of resolutions which formulated, among other things, certain principles to be observed in making appointments to the faculty and in promotions, as well as in the apportionment of funds to the purposes of elementary and advanced teaching. There was no thought of raising any question as to the constitutional force of these resolutions; but I feel sure that I can say that they were adopted with the president's hearty concurrence and approval and are accepted by him as the voice of the faculty.

I mention these things because they seem to point in a significant and encouraging way to the happy solution of our problems. The growing sense of the duties and responsibilities that are laid upon members of faculties by their commission to "discern, recommend, and carry out the educational policies of the institution" will give rise to a new feeling of loyalty and *esprit de corps* that will lead to something better than a "class" feeling on the part of university teachers—a consciousness of the dignity and value of their own profession which will make them more useful members of society. No one can doubt that the university president who works quietly and patiently towards this result will have a far more enduring title to fame than if he had covered the campus with marble buildings or had been the inventor of a much-heralded "elective" or "preceptorial" system.

That university presidents and other administrative officers have felt and will continue to feel the new drift of things there is no serious reason to doubt. It would not be fair to assume that they are unwilling to cooperate in a democratic movement as soon as faculties show a disposition to assume their proper responsibilities and rise to "the point of view of the whole." Indeed, the strength of the president's position has consisted in the fact that he has attempted to represent, however inadequately, the interests of the university as a whole, while members of faculties have often failed to see beyond their own departments. The objection, therefore, that a democratic movement can look for nothing but obstruction from administrative officers seems unduly pessimistic. There may indeed be such cases, but patience and good feeling will do much to dispose of them. And, after all, no man or set of men can long obstruct this movement. Stephenson's reply to the objection regarding the danger of the cow getting on the railway track seems to fit the case—"it wad be verra' bad for the coo."

No changes in external organization can compare in importance with the birth of the new spirit that I have ventured to predict, or be properly regarded as a substitute for it. Nevertheless, it seems likely that this new spirit will demand, as time goes on, new and more adequate forms for its expression. The multitude of distracting duties that the presidents of the larger universities are called upon to perform prevent them from keeping in touch as closely as is desirable with the educational work of the faculties. It is also unfortunate that university presidents are no longer teachers, and that no leisure is af-

forded them for productive work. An interesting suggestion in this connection has been made by Professor Cattell. In a letter to the New York *Evening Post*[3] he proposed that there should be a division of the office by the appointment of both a president and a chancellor. The general idea underlying the proposal is that the president should be the leader of the faculty in educational affairs and that the chancellor should represent the university locally and before the world. It is to be hoped that questions of this nature will continue to be discussed freely and frankly both by university presidents and professors. The subject might perhaps be discussed profitably by the Association of American Universities. That body should, however, realize, as a preliminary to any discussion, that there can be no real association of American universities in which the faculties of the universities are not represented.

J. E. CREIGHTON
CORNELL UNIVERSITY.

REPORT OF THE PERMANENT COMMISSION OF THE INTERNATIONAL SEISMOLOGICAL ASSOCIATION

THE writer attended the conference held at Zermatt, Switzerland, August 30 to September 3, 1909, as the delegate for Canada. It was well attended. Of the twenty-three countries forming the association twenty were represented, as follows: Austria, Belgium, Bulgaria, Canada, Chile, Denmark, England, France, Germany, Greece, Hungary, Italy, Netherlands, Norway, Portugal, Roumania, Russia, Servia, Spain and Switzerland. Regret was expressed that the United States did not send a representative. Besides the delegates, other scientists were present, making the total in attendance 42.

Professor A. Schuster presided, and Dr. Hepites, of Bukarest, was elected vice-president for the remaining two years, when the general meeting will be held in July, 1911, at Manchester, England.

[3] October 5, 1901.

Mention may be made of several reports of committees appointed at The Hague meeting in 1907. The one on bibliography recommended that arrangements be made with the International Catalogue of the Royal Society for the publication in one volume of all papers on seismology.

The committee on "Catalogue," *i. e.*, for the publication of the catalogue for the earthquakes of 1906, held several meetings before a compromise was effected between different views on the character of classification, regional or chronological. Considerable expense is involved in the preparation of a catalogue, hence its contents should serve scientific ends especially.

From the report two years ago to this association of The Hague meeting it will perhaps be recalled that makers of instruments had been invited to submit for competition a simple seismograph, with magnification forty to fifty and costing in the neighborhood of seventy-five dollars. The testing of the apparatus was to be done at the Central Bureau at Strassburg, and the award was entrusted to a committee of five members. Three instruments were submitted and subsequently tested. The committee on instruments found that the terms of competitions had not been rigorously adhered to; that the price set for an efficient instrument was too low and not in keeping with the precision required in seismological work of the present day; that however good work had been done by the manufacturers for the above seventy-five dollars; and that no prize be awarded, but instead the money, some $250, be equally divided between the three manufacturers, in a measure as compensation for their efforts. Emphasis was laid in the report on the fact that the first consideration of a scientific instrument is efficiency; the cost being a secondary consideration.

Nearly every country represented presented a report on its respective seismological service.

Of the numerous papers presented there were several of particular interest. Professor Hecker presented the results of his ob-

servations, extending over a period of nearly seven years, of the deformation of the earth under the influence of the moon. The instrument (or instruments, for two were set up) used was a horizontal pendulum, in short a seismograph, placed in a well some eighty feet deep to eliminate the heat effect of the sun. As the theoretical displacement of a pendulum through the attraction of the moon is a definite quantity, readily computed for an absolutely rigid earth, the actual displacement gives a measure of the yielding of the earth itself, *i. e.*, of the degree of rigidity. Hecker's observations confirmed previous determinations made however by different methods, that the rigidity of the earth is somewhat greater than that of steel. The tide of the solid earth is from four to six inches. An interesting point brought out too was, that there is very little lag in this earth tide, *i. e.*, that "high earth" corresponds to the transit of the moon for any place.

Another interesting paper was that of Prince Galitzin on the determination of the azimuth or direction of the epicenter from the comparison of the corresponding amplitudes of two horizontal pendulums at a single station, one mounted in the N.–S., the other in the E.–W. direction. He showed the interagreement of his deduced azimuth for a dozen known earthquake centers with the theoretically computed one.

The method of obtaining the distance to an epicenter has of course for some time been readily available from the time interval between the different phases of an earthquake record; for instance, between the arrival of the first longitudinal waves and the first transverse waves; or the first long waves.

Of any individual question or subject discussed, the one on microseisms elicited the most interest. These microseisms or earth tremors have been observed practically over the whole earth, and are quite distinct from pulsations produced by earthquakes. They last for hours and days, and have a period of about five seconds. The actual amplitude (half range) of the earth particles reaches five microns, or one two-hundredth of a millimeter.

The writer communicated the results of his investigation extending over several years, which shows that they are due in the first instance to areas of low barometer, surrounded by steep gradients, and in the second place, that such an area of low barometer is far more effective in producing microseisms when it is resting or passing over water, that is, the ocean. Experience shows that for the Atlantic coast the microseisms appear more strongly *after* the area of low has passed the recording station and reached the ocean. Per contra, in Europe the reverse should obtain, as in general atmospheric movement between Canada and Europe is easterly, that is, the microseisms there should show themselves *before* the low reaches the land.

A special committee was appointed to further investigate this interesting problem, and to that end it is probable that one or more instruments, especially designed for the purpose, will be set up on the seashore to record the pulsations of the water.

The present mareographs or tide-gauges are not adapted for that purpose, the time-scale being far too small, for one must be able to read at least to five seconds of time on the record. A thousand Marks, or $250, was placed at the disposal of this committee.

The conference was successful in every respect. The members were all housed in the same hotel, and this enhanced the opportunity of "heart to heart" talks which are really the most valuable assets that meetings of scientific men offer.

Otto Klotz

THE GRADUATE SCHOOL OF AGRICULTURE

The fourth session of the Graduate School of Agriculture, which has been in progress for the past four weeks at the Iowa State College at Ames, was brought to a close July 29.

The session was entirely successful from the standpoint of numbers enrolled and character of the lectures given. The total enrollment was 207, in this number 39 states, the

District of Columbia and six foreign countries were represented. This enrollment showed nearly 43 per cent. increase over the previous session in 1908. The number of states represented is very significant of the fact that the American Agricultural Colleges as a whole are coming to realize the benefit of the sessions of the Graduate School to their instructional and experimental staffs and to American Agriculture at large.

The faculty was composed of experts from the United States Department of Agriculture, Agricultural Colleges of the United States and Canada, Biological Departments of several universities, the Carnegie Institution at Washington and from two foreign countries; Dr. J. C. Ewart of the University of Edinburgh, delivered five lectures on Animal Breeding and Dr. Von Tschermak, of the Royal Imperial Agricultural College of Austria, delivered five lectures on Plant Breeding.

Discussions of the latest theories and investigations relating to agricultural development were interesting and very resultful. Men in attendance at this session of the Graduate School have become better acquainted with and have a broader knowledge of the progress of agricultural investigation than ever before. Investigators from the north, south, east and west are now much more united in the problems of agriculture.

W. H. P.

SCIENTIFIC NOTES AND NEWS

DR. JOHN F. ANDERSON has been made director of the Hygienic Laboratory of the U. S. Public Health and Marine Hospital Service to fill the vacancy caused by the removal of Dr. M. J. Rosenau to Harvard University.

PROFESSOR WILLIAM H. WALKER, head of the research laboratory of applied chemistry of the Massachusetts Institute of Technology, has been elected president of the Electrochemical Society.

FOREIGN members of the Royal Society have been elected as follows: Dr. Svante Arrhenius, Dr. Jean Baptiste Édouard Bornet, Dr. Paul Ehrlich, Professor Vito Volterra and Dr. August Weismann.

SIR E. RAY LANKESTER has been elected a foreign associate to the Paris Academy of Sciences to fill the vacancy caused by the death of Robert Koch.

PROFESSOR FILEHNE, the Breslau pharmacologist, has been elected a foreign member of the Paris Academy of Medicine.

THE Steiner prize of the Berlin Academy of Sciences, which is of the value of $1,500, has been awarded to M. Gaston Darboux, of Paris, for his publications in geometry.

THE Astley Cooper Prize has been awarded by the Guys Hospital School to Professor E. Starling, F.R.S.

DR. KARL VON DER MÜHLL, professor of mathematical physics at Basle, has been given the doctorate of laws by that university.

PROFESSOR HENOCH, who for many years was at the head of the department of children's diseases at the Berlin Charité, celebrated the completion of his ninetieth year on July 16.

MR. JOHN RAMSBOTTOM has been appointed assistant in the department of botany of the British Museum of Natural History, where he will devote himself to the fungi.

MESSRS. G. O. SMITH, Waldemar Lindgren, George F. Becker, S. F. Emmons and Whitman Cross will attend the eleventh International Geological Congress at Stockholm from August 18 to 25 as representatives of the U. S. Geological Survey.

AMONG the foreign guests at the recent meeting of the British Medical Association were two Americans, Dr. George Crile, of Western Reserve University, and Dr. R. Tait MacKenzie, of the University of Pennsylvania.

DR. ROSCOE POUND, professor of law in the University of Chicago, known also to students of botany for his contributions to that science, has been selected to deliver the address at the summer convocation of the university. This will mark the close of Dr. Pound's work at Chicago, as he has accepted the offer of a professorship in Harvard University.

At the summer meeting of the Vermont Botanical Club held at Woodstock, Vermont, Dr. N. L. Britton, director of the New York Botanical Garden, delivered a public lecture in the Woodstock Opera House on the evening of July 5, illustrated by colored lantern-slides of wild flowers from the Van Brunt collection of the garden.

At the meeting of the Berlin Academy of Sciences on June 30, commemorative addresses were made on Friedrich Kohlrausch, by Professor Rubens; on Hans Landolt, by Professor van't Hoff, and on Robert Koch, by Professor Rubner.

The Rev. Robert Harley, F.R.S., a congregational clergyman, well known for his important contributions to mathematics and symbolic logic, died on July 26, in his eighty-third year.

The death is announced of Mr. J. Ellard Gore, well known for his numerous publications presenting the facts of astronomy in popular form.

The first International Congress of Entomology met in Brussels from August 1 to 6, under the presidency of M. Schollaert, the Belgian minister of agriculture. Among the lectures and addresses of general interest announced on the program are the following: W. Bateson, "Mendelism"; R. Blanchard, "Medical Entomology"; O. Cruz, "Prophylaxis of Yellow Fever at Rio de Janeiro"; F. A. Dixey, "Mimicry"; A. Forel, "The Distribution and Phylogeny of Ants"; G. B. Grassi, "The Transmission of Diseases by Insects"; A. Handlirsch, "Fossil Insects"; R. Heymons, "The Ontogeny of Insects"; W. J. Holland, "The Preservation of Types"; J. Kundel d'Herculais, "Locust-Plagues"; E. Wassman, "Ants."

At the meeting of the Association of German Scientific Men and Physicians, to be held at Königsberg beginning on September 18, the addresses at the general sessions are as follows: "Epistemology and Science," Professor Külpe, of Bonn; "Puberty and the School," Professor Craemer, of Göttingen; "The Localization of Brain Function," Professor von Monakow, of Zürich; "The Attitude of the Newer Physics to the Mechanical View of Nature," Professor Planck, of Berlin. In connection with the meeting there will be an excursion, starting from Swinemünde on September 5, going on to Wisby, Stockholm, Helsingfors, Wyborg, St. Petersburg and Riga, and ending at Pillau on September 18.

A fire, which started in a shoe store in Washington, on July 21, threatened to destroy the valuable library of the U. S. Geological Survey, which occupies the upper part of the building. The following statement has been issued by Dr. G. O. Smith, director of the Survey: "The fire originated in and was largely confined to the first floor, occupied by other tenants. It gives emphasis, however, to the wisdom of congress in authorizing at its last session the preparation of plans for a government building that will not only be better adapted to the peculiar needs of this scientific and map-making bureau, but will insure the safety of the public records, that have been five times endangered by fire destruction since 1903. The fire originated in one of the several stores over which the survey watch force have no control, but in a few moments the flames had burst through into the survey laboratory situated directly above. The loss of government property is thought to be less than $1,000, but an incalculable loss might easily have been incurred in this library, which is unique in its collection of geologic literature, containing as it does more than 65,000 volumes, as well as 85,000 pamphlets and 35,000 maps, and constituting the most complete collection of geological works and maps in this country, if not in the world. The destruction of these by fire would have deprived not only the geologists of the survey, but the scientists of America, of a reference collection that could not be duplicated. Indeed, in spite of the quick response of the fire department, if the watch force and some of the members of the survey, who were in the building, had not promptly used hand extinguishers, the damage to books and maps must have been considerable."

IN the August number of the *Astrophysical Journal* Professors Kapteyn and Frost give a determination of the velocity of the solar system through space as derived from the radical velocities of the Orion stars. There appears to be a difference of ten kilometers per second between the results obtained by the stars near the Apex and those near the Antapex. Kapteyn now finds not far from each of these two regions an extensive group of Orion stars having common proper motion. The difference just mentioned is probably to be explained by this fact. A discussion of these groups will follow in one of the next numbers of the *Astrophysical Journal.*

THE *Journal* of the New York Botanical Garden states that Dr. W. A. Murrill, assistant director, recently returned from Virginia with a collection of poisonous fungi, which will be chiefly used for chemical analysis. Returning, he found evidences of the chestnut canker not far from Baltimore, Md., and diseased trees became more abundant northward. At Belair, Md., seventy-five miles south of Philadelphia, and at Northeast, Md., the effects of the canker were very noticeable, most of the chestnut trees being dead or in a dying condition. At Red Bank, N. J., where the first chestnut trees were observed near the coast, the disease had become very serious and was noticed from this point all the way to New York City, especially near South Amboy, N. J., where whole forests were either killed or badly affected. Throughout the whole of Staten Island, not a single healthy chestnut tree was observed.

THE annual meeting of the general committee of the Imperial Cancer Research Fund was held at the Royal College of Surgeons, London, on July 20, Mr. A. J. Balfour being in the chair. We learn from the report in *Nature* that Sir William Church presented the annual report, and gave an exposition of its most salient features. The Duke of Bedford, who has been a strong financial supporter of the fund from its foundation, was elected president. Mr. A. J. Balfour moved a vote of thanks to the members of the various committees, and to Dr. Bashford and his staff. Mr. Balfour's remarks were mainly directed to the laymen, and have received such wide publicity in the daily papers that we need not quote them in full, well as they will bear quoting. Mr. Balfour emphasized the progress made since he presided in July, 1903, and directed attention to the caution characterizing the statements emanating from the laboratory, urging the need for patience upon the public, the members of which are not always able to comprehend that the slow progress made by scientific methods is the only progress that can legitimately be expected.

THE University of Leeds, formerly the Yorkshire College of Science, and subsequently the Yorkshire College, has, says the London *Times,* in its history of thirty-six years, been largely indebted for its growth and development to the Clothworkers' Company of the City of London. The textile industries department was the first of the technical departments established. Its initiation was due to the Clothworkers' Company and to a small number of Leeds and Yorkshire manufacturers, who recognized the importance and value of courses of study in textile industries. Since 1874 the textile industries department has received large grants and endowments from the Clothworkers' Company. On capital account the company has up to the end of the present session contributed £70,000 and an annual maintenance subsidy of £4,000, and it has now added £5,000 to its capital gifts to extend the spinning section for the purpose of introducing, experimentally, into the curriculum of study the continental system of worsted-yarn manufacture.

A SCHOOL of aviation is to be established near London in memory of the late Mr. C. S. Rolls. *Nature* states that a sub-committee of the Aerial League has had the scheme under consideration, and its cost for the first year is likely to be £2,500. The primary aim of the school will be to provide training in aeroplane manufacture and flight, and to obtain a class of men grounded in the subject from beginning to end, including such laboratory and

theoretical work as funds and the gifts of apparatus may permit. The laboratory will be open for the use of students from technical institutions already providing elementary classes in the theory of flight, and also for public demonstrations in order to spread an interest in aeronautical science. Men who have undergone courses of training in engineering schools, and competent engineers and mechanics, will be eligible as students. The practical work of students will be directed to securing machines offering greater stability and trustworthiness, lower power and fuel consumption, diminished capital cost and expense of maintenance, and a higher factor of safety than the apparatus now used. In order that an early start may be made, two machines are to be bought at once, and the students will build all further machines, and also those of selected inventors whose ideas are judged to be worthy of construction and practical trial. The funds will be administered by an independent committee of management, including practical men of science. Mr. Patrick Y. Alexander has offered to equip the proposed laboratory with the necessary practical apparatus. The new institution will probably be called the Rolls Memorial School.

The approaching exhaustion of the world's richer known lead-producing districts gives special interest to the study of any possible source of lead in countries where increasing prices or improved methods may soon make even low-grade deposits valuable. Accordingly the United States Geological Survey has published a report by L. J. Pepperberg on the little-known lead field of the Bearpaw Mountains, in Montana. This report will be contained in the Survey's Bulletin 430, giving the results of some work done by the survey's geologists in 1909, but has also been issued separately in an advance chapter on lead and zinc. The region considered was long ago prospected for gold and silver, but no valuable mineral deposits were found until about 1888, when work was begun on a vein of argentiferous galena near Lloyd. A claim on this vein was patented in 1892, but work was suspended because it proved to be unprofitable. Since that time several other claims have been patented and some work has been done, though no ore has yet been produced. The rocks in this region are widely mineralized. The ores were probably deposited by hot waters ascending from great depths. Later, during the long-continued wearing down of the Bearpaw Mountains by erosion and weathering, the metallic minerals were dissolved, carried down again into the rocks by rain water, and redeposited in concentrated form within moderate distances of the surface. The ore contains a little gold, 40 or 50 ounces of silver to the ton and 50 or 60 per cent. of lead and is easily crushed and concentrated. More thorough prospecting in this region may develop ore bodies of greater value.

UNIVERSITY AND EDUCATIONAL NEWS

By the will of the late Mrs. Frances Irving Weston, of Boston, the Massachusetts Institute of Technology is given $10,000 for two scholarships.

By the will of Mr. Henry Dixon, London University receives £10,000, the income of which is to be used for scientific investigation.

Dr. Frederick W. Carpenter, of the University of Illinois, will spend the coming academic year in Europe on scientific work. His place at the university has been filled by appointment as *ad interim* instructor, of Mr. William F. Allen, who has been for several years in charge of the biological laboratory maintained by the University of California, at Pacific Grove.

Dr. Addison W. Moore, professor of philosophy in the University of Chicago, will spend the winter and spring at Stanford University, to fill the vacancy caused by the absence of Dr. George H. Sabine.

Dr. Edward F. Malone, of the Wistar Institute of Anatomy, has been appointed assistant professor of anatomy in the department of the University of Cincinnati of which Professor H. McE. Knower was recently appointed head.

DR. J. FRANK DANIEL, instructor in zoology in the University of Michigan, has been appointed to a newly-established instructorship in comparative anatomy in the University of California.

PROFESSOR JACOB WESTLUND has been promoted to a full professorship of mathematics at Purdue University.

AT the University of Kansas Drs. C. H. Ashton and J. N. Van der Vries have been promoted from assistant professorships to associate professorships of mathematics. Dr. U. G. Mitchell, of Princeton University, and Drs. Arthur Pitcher and M. B. White, of the University of Chicago, have been appointed assistant professors of mathematics.

MR. A. E. FINDLAY, has been appointed to a newly instituted lectureship in applied chemistry at Sheffield.

As successor of Professor Verworn, Professor Jensen, of Breslau, has been called to Göttingen as professor of physiology.

DISCUSSION AND CORRESPONDENCE

A SUGGESTION AS TO THE CARE OF TYPES

EVERY student of zoology or botany is aware of the immense importance of types, the original specimens upon which new names have been based. At the present time such types are scattered over the country, in public and private collections, and many of them are likely to be destroyed or lost. Many, though in safe custody, are in such out-of-the-way places that it is practically impossible to gain access to them.

I do not believe that any naturalist who has visited many museums can be satisfied with the care usually taken of types. On the contrary, it would be easy for any one with much experience to write an article in the best "muck-raking" style, describing some of the things he has seen. Possibly such an article might do good, but nobody is willing to write it. At the same time, something ought to be done. It occurs to me that a possible way to mend matters would be for the American Association to appoint a committee to investigate and report. This committee, of perhaps six members, should be permanent, and should have enough funds placed at its disposal to enable its subcommittees of two or three to visit all the principal institutions in which types are preserved. In the course of a few years it would be possible to report the exact conditions found, and certain museums could be designated as fit places for the preservation of types. Neither the association nor its committee could force anybody to do anything, except through the pressure of scientific public opinion, but this would doubtless in many cases be sufficient.

A few general principles might be enunciated, for example:

1. A type is, from its nature, in some sense the property of the scientific world. Thus, every one would consider it a criminal act to purchase and then willingly destroy a type. It must be considered reprehensible to permit types to exist where they are in serious danger of being destroyed, and, in particular, steps should be taken to prevent the sale of types to miscellaneous unknown collectors after the death of the original owner.

2. Every institution possessing types should publish a complete list of those in its custody, and subsequently annual lists of additions. It can then be held strictly accountable for their care, and students can ascertain where the types are to be seen.

3. No types should ever be loaned out, and, especially, they should never be sent through the mails. Experience shows that institutions which profess to have a rule against the loaning of types can not be trusted to keep it. I regret to say that I have in the past occasionally loaned types to reliable students and institutions, and have found it extremely difficult to get them back. It may be necessary some day to publish a few explicit statements under this head.

It is impossible to absolutely safeguard types in all instances. It must be recognized that *some* risks, under existing circumstances, are unavoidable. For example, I have at this moment in my custody considerable collec-

tions of bees from the British and Berlin Museums. When I have finished working on them there will be more than a hundred types of new species, and all of these must go back to London and Berlin by express. Owing especially to the carelessness of custom-house officials, there is a genuine enough risk of damage. These very collections were injured on the way here, because the officials in New York unpacked them, and repacked them carelessly, so that the sides of the insect-boxes rested against those of the outer cases. Nevertheless, it seems that the whole transaction is worth while. The damage, if any, will not be great, and the museums in question will be enriched by a large amount of type material.

My own collection of bees, containing hundreds of types, is in a good but not fire-proof building. When I die, it is intended to transfer it to the National Museum. Some years ago I sent most of my types to Philadelphia and Washington, where they now are. Recently, I have refused to part with any, concluding that the material is safer and more useful in my own custody, where it is continually being studied. There is some risk here, but with apparently adequate compensating advantages.

In the case of the types which I have loaned, it may be plausibly argued that I should not take the risk of having them returned by mail or express. I am so far convinced by this that some of them, which are in trustworthy institutions, will be permitted to stay where they are. Others, now in private hands, may be placed in such institutions. One word may be added concerning the purchase of types by institutions. The natural outcome of the work of the proposed committee will be to make it more or less obligatory for students to leave their type material to the larger museums. Many will do this in any case. Unfortunately, these museums will usually take every advantage of this condition, and will either expect to receive the material gratis, or pay as little as possible for it. Naturalists are commonly ill-provided with convertible riches, and often their collections, the work of their lives, are their most valuable assets. It is not fair that they should be virtually compelled (as in a number of actual cases I could cite) to give them away to the public, without any pretense of an adequate return. Possibly a special type fund might be raised to meet this condition, but there might be some danger that if describing became too profitable (through the sale of types) it would become commercialized, with results awful to contemplate! This difficulty could be overcome, no doubt, by keeping the prices at an optimum which would avoid both extremes, and by the vigorous condemnation of reckless work. Prices might also vary according to the character of the work represented by the collections.

T. D. A. Cockerell

University of Colorado,
June 9, 1910

MEDICAL EDUCATION

To the Editor of Science: The teaching of medicine in the United States is notoriously antiquated, ill-organized and open to commercial influences. To most doctors concerned for the future the publication of "Bulletin No. IV." of the Carnegie Foundation for Teaching is an occasion of importance and the precursor of great things. It is a pity then that the editor of the *New York State Journal of Medicine* should have conceived such a distaste for the authoritative style of the writer of the bulletin as to limit his praise to an acknowledgment in ten words that "much useful information and valuable criticism" are contained in it, and to abuse it in four columns.

Mr. Flexner's conclusions are hardest for the editor to accept because presented with vigor and finality. But this is as it should be: a work for the reform of established abuses can not proceed with apology or hesitation. If the author observe fairly and judge impartially, he must drive home his conclusions with all the weight that conviction can give them—and this is what the bulletin does. There are many who have a direct interest

against reform; there are others who find it painful to change from methods which were useful and the best in their day, and who resent criticism of them; much crass opposition has to be overcome. For this task detachment from the profession was necessary. It was an extraordinary advantage, therefore, that the work should have been undertaken by one of the leading pedagogical authorities of the United States: pedagogy is one of the greatest of sciences because it serves all others, and it deserves the warmest welcome from our profession. Starting from this favorable approach, Mr. Flexner has been able to add the assistance and advice of such men as Dr. Welch, Dr. Simon Flexner and Dr. Bevan to his own power of diagnosing the causes of evil, his inescapable criticism and incisive style, and his comprehensive vision for solutions. And for the report prepared under this fortunate combination of circumstances and abilities the widest circulation has been made possible by "access to the pocket of a multimillionaire."

The reviewer ridicules the condemnation of proprietary and fee-dividing schools by arguing that four of the faculty of Johns Hopkins (which in the bulletin is held up as the model for medical schools) were graduates of such institutions. It may be asked where men were to be obtained when this school was founded except from the proprietary and fee-dividing schools; there were no others. It may, with like reasonableness, be asked why those who were brought up under the old method devised the new one, unless they thought it better. In the case of these men we are not left to inference; they have spoken and written against the method under which they were educated. They lend their names also to the authority of this bulletin.

The inherent vice of the argument is apparent. The issue is not whether Dr. A. is a skilled surgeon or Dr. B. a capable physician, but whether we can better our medical teaching. Defence of a school system because distinguished doctors have come out of it, is in logic the method of the empiric in medicine. A logic which opposes the names of individual "giants" produced by old and vicious systems of education to proposals of better instruction for all in the future, would carry us crab-like to the schools of Ambroise Paré and Vesalius, and eventually to the times of Galen and Hippocrates as the golden period of medical education.

Mr. Flexner's advocacy of laboratory and hospital work is marred for this writer by supposed injustice to the value of didactic teaching. The bulletin does not urge its abandonment: it lays the emphasis where in the study of a science it is needed, namely, upon contact with facts, with observed causes and consequences. The medicine of to-day rests, to an extent undreamed of in the past, upon the scientific foundation of laboratory and hospital knowledge, and acquaintance with details at second hand no longer suffices. Students will not be satisfied with looking on while some one else does the work; they will insist on working with their own hands and their own brains on real facts. The best law-teachers found this out when they supplanted the abstractions of text-book teaching with the close study of real lawsuits. The study of books alone will make good examination candidates, but it will not make good doctors: skill is defined as "personal expertness or dexterity," and the world is less in need of men who can quote text-book descriptions of diseases than of men who are "skilled" to cure. Handling of facts is the basic thing, and then supplementary information and breadth of view may be had from didactic teaching. As the bulletin says:

> The lecture—hugging as closely as may be the solid ground of experienced fact—may therefore from time to time be employed to summarize, amplify or systematize.

The editor's final perplexity is over Mr. Flexner's insistence upon a connection between medical school and university. "Until recently," the reviewer says, he himself "thought it of enormous advantage for a medical school to be in close relationship with a university." The phraseology leads to the conjecture that he thinks so no longer, and that in a brief period of his cogitations what was recently

"enormous" has shrunk to a negative quantity. An outline or explanation of his views on this important and complex question would have profited our understanding of his conversion, but he does not give them. Two inconsiderable items of college gossip are mentioned, but we can not believe that they form the basis for so radical a change of heart on so broad a question.

One of these items is the rumor that Columbia University is about to establish a course in optometry. The reviewer himself does not think it "possible that so treacherous a blow would be struck at its medical department by the university." There is no occasion to find fault with this hopeful opinion which is wholly in accord with the facts, and controversy is impossible where agreement is complete. It may be remarked, however, that whether the university may or may not have done good to the medical school, the connection with the medical school (if the reviewer's reasoning be correct) has in fact kept out quackery which might otherwise have entered the university. This is a reason for the connection which had not occurred to Mr. Flexner, and the credit for it should be given to the editor of the *New York State Journal of Medicine*.

The second item of the reviewer is that the presidents of the universities of three medical schools were appealed to for help in last winter's battle with the anti-vivisectionists, and refused because they feared to lose contributions from "persons of large wealth." The implied argument that, in general, managers of proprietary and fee-dividing institutions, or even of separately endowed schools, are less in need of money than universities, and therefore more likely to be defiant of ignorant public opinion, deserves no serious consideration. The instance with which the writer attempts to support it rests upon a double innuendo: the innuendo of fact, that a duty rested upon the three presidents to make "personal appearance upon the platform" and that none of them appeared, is in both respects erroneous; the innuendo of motive, that the attitude towards the question of Dr. Butler, Dr. Schurman and Chancellor McCracken was controlled by their timid venality, may be left for them to answer—if there be anything in it worth answering.

Reviews of this character are to be expected. The instinct of conservatism—contentment with what is familiar—begets tradition; the break-up of tradition goes counter to this natural tendency of the mind, and often gives pain. The reformer is disliked for giving pain, and found guilty of "innovation," "arrogance" and "self-sufficiency." Even the most intelligent and profound study of conditions does not absolve him from this personal attack; such study rather intensifies it, for the more penetrating his examination of the facts, and the more unanswerable his conclusions, the less there is to be said about them and prejudice has the more to confine itself to indefinite personalities.

The epithets that are certain to be directed against Mr. Flexner need not, therefore, chafe him. If medical education have in it germs of progress, it will go forward along the lines he indicates. The best schools will adopt them; some of the inferior schools will change more slowly; others will linger and die. Imperfectly and unevenly as usual, with imperceptible gradations between the apparent stages, and against sincere and insincere opposition, progress will come.

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QUOTATIONS

THE NEW COLLEGE IN THE WEST

That a new college, however well endowed, is about to be added to the great array of colleges and universities now existing in the country, would not, of itself, be matter for special notice outside the section immediately affected. But the statements that have been made about the plans and purposes of Reed College, the institution to be opened a year hence at Portland, Ore., are of a character to attract great interest, especially when the nature and value of college education are the subject of such active discussion and controversy. There are at least two points of great

interest in the recent interview in the *Evening Post* with the president of the college that is to be.

The first is that the productive endowment of $3,000,000 with which the college starts is to be used exclusively for college work—university work will not be attempted at all. There is a wayside inn near the White Mountains, of which the cards read thus: "What, second-class? Sure! The only second-class hotel in New Hampshire." A college without a university attachment is as rare as a second-class hotel; but President Foster wishes it understood that that is what Reed College is going to be, for some time to come at least. The adoption of this program means something more than the mere devotion of the whole income of the college to the work of college teaching. It means a concentration of the thought of the president and faculty on the demands of the college, and the elimination from the college problem of some elements of difficulty that come entirely from the merging of college purposes with university ambitions. That certain great advantages come to college students from the presence of the university work alongside that of the college is undeniable; but that much confusion of purposes has also come from the combination is equally certain. Especially are the excesses of the free elective plan, against which so strong a reaction has now set in, largely to be traced to this source. The working out of a college system in a new environment, with the distinction between college and university emphatically in mind from the beginning, should prove highly interesting and instructive to the whole country.

The second point to which we have reference is closely allied to the first. "The sort of men I am looking for," said President Foster, "must be men, first of all. Second, they must be teachers. Their proficiency as research scholars will rank third in importance with me. In some of our universities, the order of these qualifications appears to have been reversed—to the detriment of the students, I believe." The fact is, of course, that the relative importance of these qualities in college teachers is altogether different from what it is in university teachers. Helmholtz was—with occasional important exceptions—a very poor lecturer, but his students got from him what they could not have got from the most perfect teacher in the world; and the same is true of many of the greatest investigators. Sometimes the power of the perfect teacher and the genius of the great investigator are combined in one man, and that, of course, is the best thing possible, whether in college or in university; but in the university, where men are being trained to be specialists and investigators themselves, the example of the great leader is of infinitely more importance than the instruction of the perfect teacher. In the college it is different, and President Foster's position is well taken. Still, even in the college, there is danger of going too far—or perhaps rather of going in the wrong direction—in the search for teaching quality. To make teaching truly effective in the higher departments of thought, a kind of enthusiasm and insight is requisite that the *mere* teacher can hardly possess; an enthusiasm and insight that come only with hard work in one's chosen intellectual domain. But, on the other hand, it is a cruel waste and injustice to put ardent young men, ready to respond to the appeal of a genuine teacher, under the instruction of a mere specialist, without sympathetic quality, without the power of expression, without the vital impulse of the true teacher; and this is what happens in hundreds of cases in our colleges. The new college will do a great service if it sets up a true standard in this extremely important matter.

With a clean sheet before him, the president of the new college on the Pacific might, we would suggest, profitably consider a question which bears on the character of his own functions and which is also intimately connected with that matter of the personal qualities of the professors on which he has laid so much stress. The autocratic college and university president is a peculiar product of America, and a product that is especially curious as contrasting with the democratic ideals of our

political system. But it is not on the basis of an abstract doctrine of democracy that criticism of this one-man-power system rests. The position of a college professor, and even of the younger college teachers, should be a position of dignity, independence and the fullest measure of self-respect. In most of our colleges we have fallen into the habit of elevating coordination, discipline, "harmony" in the faculty, to a position of utterly factitious importance. What is wanted is not these things—or at least a very little of them is quite sufficient—but dignity, spontaneity, independence, intellectual self-assertion. In no way could President Foster more magnify his office than by belittling it. A college faculty does not need a boss; its efficiency is neither to be attained nor to be measured by the methods that apply to a factory or a department store. If what the college needs in its professors is men who are real men and true teachers, it must not treat them as wheels in a big machine. There is a vast difference in this regard between some of our colleges and others; but there is a fine opening for a new college to show what a college can be in which the idea of personal domination by the president is wholly abandoned, and that of a company of gentlemen and scholars working together, with the president simply as the efficient center of inspiration and cooperation, substituted in its stead.—*New York Evening Post.*

SCIENTIFIC BOOKS

General Biology. A Book of Outlines and Practical Studies for the General Student. By James G. Needham. Ithaca, N. Y., The Comstock Publishing Co. 1910. Pp. xiv + 542; 287 figs. Price $2.

Dr. Needham's "General Biology" is not merely a treatise on botany and zoology, as are so many books of a similar title, but it is a work whose primary aim is to teach fundamental biological facts and principles, drawing upon both plant and animal kingdoms for the material best suited for this end. In the first chapter on The Interdependence of Organisms are discussed three typical cases of the interrelation of organisms: (1) the relations between flowers and insects, (2) galls and (3) the relations between ants and aphids. There are directions to guide the student in collecting material and making observations on each of these subjects. Enough of description of the structure of plants and insects is given to enable the student to appreciate the biological relations of these organisms. This done, the study of structure is discontinued.

After this introduction to the ways of the living world the author proceeds to give the student a general notion of what the living world is. In the second chapter on The Simpler Organisms there is a brief description of several types of lower plants and animals with some suggestions for their collection and study in the laboratory. The principal forms treated are *Closterium, Spirogyra, Nitella, Amœba, Paramœcium, Stentor, Vorticella,* yeasts, molds, bacteria, slime molds, flagellates and a gregarine, in the order named, and there are sections on protoplasm, the chemical constituents of the cell, nutrition, fission and sexual reproduction.

Chapter III., on Organic Evolution, comprises about one third of the volume. It begins by continuing the general survey of the organic world begun in the previous chapter, describing an ascending series of type forms of both kingdoms. These include *Conocephalus,* a fern, and some phanerogams in plants, and *Hydra,* the earthworm and the salamander in animals, with a brief account of the embryology of the last type. This very general survey is followed by a discussion of homologies, with practical exercises for the student in tracing out homologous parts, the paleontological record, the relation of ontogeny and phylogeny, and other topics which commonly fall under the rubric of "evidences for evolution." Natural and artificial selection, orthogenesis and segregation are treated in a final section on "attempted explanations."

The various forms of reproduction, metamorphosis, regeneration and grafting are treated in a chapter on the Life Cycle. Chapter VI., on The Adjustment of Organisms to their Environment, is one of the

most original and valuable in the book, and the student who does the work outlined in it can not fail to get a much better insight into many things in the world about him. The local distribution of plants and animals is first taken up and the student is set to study plant societies and the particular habitations and habits of the animals of a restricted locality. There is a section on pond life, with directions for the study of the animals found in the pond. Then comes a discussion of symbiosis, parasitism and pollen production as affected by its mode of distribution. The third section of the chapter is devoted to the adaptations of aquatic insects—forms admirably fitted to illustrate adaptation—and a consideration of animal coloration as cryptic, warning and mimetic.

The final chapter deals with the responsive life of organisms. Beginning with the behavior of the protozoa the author proceeds to consider reflex action, the general architecture of the nervous system, instinct and the simpler modes of learning through trial and error. The last part of the chapter is concerned with the natural history of man and various human institutions—a subject which naturally can be dealt with in only the briefest way, although the discussion may serve its purpose of giving a general notion of the relation of man and human society to the rest of the animal creation.

The course of instruction which Dr. Needham's book outlines is quite different from the usual introduction to biology. Morphology is given but a subordinate place. The student is not set to work on a series of forms to acquire a foundation of knowledge whose significance may appear some time in the future; he is plunged at once into a study of biological principles and introduced to the facts upon which they are based. It is a common practise to study several type forms and use them, so far as they are adapted to the purpose, for the inculcation of matters of general biological import. Dr. Needham, on the other hand, starts with the general subject or principle to be studied and rummages through the plant and animal kingdoms for good illustrative material. There is little gathering of irrelevant information. Selecting a number of the most fundamental and significant fields in biology, he sets the student at work in them on concrete facts. "Ecological and evolutionary phenomena," the author says, "are just as available for practical studies as are morphological types," and every teacher of biology can derive many useful suggestions from the way in which the studies of these subjects are outlined.

The relatively large amount of attention devoted to field work is one of the most salient characteristics of the book, and constitutes one of its chief merits. The selection of material for study, so far as the reviewer can judge, is judiciously made, and in the hands of a teacher who knows plants and animals in their natural environment the book will doubtless prove a valuable introduction to the study of animate nature.

The book is well printed on good paper, but very poorly bound. A considerable proportion of the figures are new and the portraits of several eminent biologists add to the general attractiveness of the volume.

S. J. HOLMES

Handbuch der Vergleichenden Physiologie, herausgegeben von HANS WINTERSTEIN in Rostock. Band II. (in part). Physiologie des Stoffwechsels. Jena, Gustav Fischer. 1910.

The day has passed when the study of comparative physiology requires a defense at the hands of its devotees. If one asks, however, why so little organized progress has been made in this field in comparison with related domains, the answer is perhaps to be found in the peculiar associations under which animal physiology and zoology have developed until quite recently. Physiology was long looked upon as a science which could only be fostered successfully in connection with a medical curriculum; as a result of this the more practical ends of the applied science always forced themselves to the front and led as a natural consequence to that splendid development of the study of mammalian functions which is well known. The activities of the lower forms

were neglected despite the attractive opportunity for investigation which they obviously afford. In the zoological institutes, on the other hand, where one might have expected the desired progress to be initiated, attention was centered for the most part upon morphological aspects of study—at any rate, for many years after purely systematic studies gave way to modern experimental methods.

The editor of the new "Handbuch" believes that the time has come to take account of the facts of comparative physiology now established and to review the situation in a more comprehensive manner than has heretofore been attempted. This is the period of "Handbücher" in the biological sciences. We may question whether it is not time for a reaction to set in—for a return from the prevailing expansionist methods of publication to those of the less cyclopædic texts where competent critique eliminates a great mass of antiquated data and gives us less voluminous, but more inspiring, manuals. In the case of comparative physiology, however, it would be unfair to say that the general literature has as yet been overdone. The usefulness of such a book as v. Fürth's "Vergleichende Chemische Physiologie" arouses the belief that the publication of a comprehensive summary of the important contributions, with an attempt at such generalizations as are now warranted, may be decidedly valuable. The names of the collaborators whom Professor Winterstein has selected inspire confidence in the undertaking. They include E. Babák (Prague), S. Baglioni (Rome), W. Biedermann (Jena), R. du Bois-Reymond (Berlin), F. Bottazzi (Naples), R. Burian (Naples), A. J. Carlson (Chicago), L. Fredericq (Liege), R. F. Fuchs (Erlangen), S. Garten (Giessen), E. Godlewski (Cracow), A. Kreidl (Vienna), J. Loeb (New York), E. Mangold (Greifswald), W. Nagel (Rostock), H. Przibram (Vienna), O. zur Strassen (Frankfurt), R. Tigerstedt (Helsingfors) and E. Weinland (Munich).

The plan proposed calls for a division of the subject according to physiological functions rather than by groups and species, thus creating a true *comparative physiology*. In connection with each topic the relations of the various animal subdivisions are to be dealt with by comparison in so far as existing knowledge justifies. The entire field is to be covered in four volumes issued in about thirty parts. The groupings of the chapters comprise The Body Fluids; Respiration; Metabolism of Matter; Reproduction; Metabolism of Energy; Physiology of Form; Physiology of Reception of, Conduction of, and Response to Stimuli.

These columns will not permit a detailed review of the four parts which have already appeared, further than to indicate their scope. Professor Biedermann has written the subdivision on the ingestion and assimilation of food. The descriptions applicable to animal forms are preceded by a rather comprehensive account (272 pp.) of nutrition in plants, primarily of the lowest types. In this the author has evidently drawn largely from such works as Czapek's "Biochemie der Pflanzen" and Lafar's "Handbuch der technischen Mykologie." The first 75 pages deal with the sources of nutriment for plants; the remainder of this introductory portion is essentially a review of the rôle of enzymes in the metabolism of plants. One might differ with the author as to the desirability of devoting so many pages to a subject which seems at first glance rather foreign to the main purpose. Professor Biedermann evidently feels that its importance has not been adequately appreciated. "Man darf wohl sagen," he writes, "dass kaum auf einen anderen Gebiete der Physiologie die *cellular*-physiologische Forschung so glänzende Resultate aufzuweisen hat, wie gerade auf dem der Pflanzenverdauung. In geradezu schematischer Klarheit tritt uns hier schon bei den Bakterien und den niederen Pilzformen die fundamentale Tatsache entgegen, dass es Enzyme gibt, welche ausserhalb der Zellkörper (extracellular) wirken (*Ektoenzyme*), wie auch solche deren Wirksamkeit nur *intraplasmatisch* (*intracellular*) zur Geltung kommt (*Endoenzyme*)" (p. 254). After a review of the literature on the comparative chemistry of nutrition, Biedermann concludes: "Es darf als sicher gelten, dass die intra- und extra-

cellulare Verdauung bei Pflanzen und Tieren Vörgange darstellen, zwischen denen kein Wesensunterschied besteht" (p. 385).

In the chapters devoted to animal forms, the nutrition of the protozoa and metazoa is considered in orderly sequence. The probable form in which nutriment is ingested is discussed, followed by a consideration of the physiological equipment of each group for the digestive disintegration of the food material and its transport within the organism. Incidentally it may be noted that the author does not accept Pütter's contention that some of the lower marine forms derive their nutriment from organic compounds dissolved in the water. Some attention is devoted to the possible significance and origin of the chlorophyll granules and so-called yellow cells (Zooxanthellen) in protozoa. References to the literature are supplied at the end of each chapter.

The first instalment of the monograph by Léon Fredericq on "Die Sekretion von Schutz- und Nutzstoffen" begins with Lieferung 4. This contains a distinctly unique compilation of the protective and defensive excretions of lower forms arranged in the sequence of the zoological system. Where possible the structural relations of the parts involved in the secretion of the fluids and substances included are described and illustrated with drawings. These chapters are certain to be very useful for reference. Among the topics included are such as the protective coverings and slimy secretions of animals, the poisons and pigments produced by them, and the relation of these to the production of pathological conditions in other animals and man. The poison in the sting of insects, the toxins of the Actinia, the acid secretion of molluscs, the melanin production of *Sepia,* the hemolysins of intestinal parasites (worms), the anticoagulant hirudin, the formation of silk, the production of waxes—are scattered illustrations of the diversity of topics included in the physiology, chemistry and toxicology of this hitherto inadequately investigated domain.

In the preface to the "Handbuch" the editor formulates the policy that in addition to a complete review of the literature there must be an effective separation of established facts from untenable speculations and inadequate observations. In the two specimen monographs already available these aims have been followed faithfully in so far as the omission of uncertain hypotheses are concerned. If the subsequent installments of Winterstein's "Handbuch" maintain the standards here set, its place as a desirable reference work for biological investigators is assured.

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The Elements of the Science of Nutrition. By GRAHAM LUSK. Second edition, revised and enlarged. Philadelphia and London, W. B. Saunders & Co. 1909. 8vo, 402 pp. Cloth $3.00 net.

During recent years the American literature has been rich in dietary studies which have added much to our knowledge regarding accounts of nutrition. The publication of these studies by Atwater, Benedikt, Langworthy and others in public documents has awakened a wide-spread interest among others than students of nutrition. It is not the purpose of the reviewer to criticise adversely such publications, for their value is unquestioned, and this value lies chiefly in the attention they have attracted at the hands of readers who have not made a study of nutrition and whose reading must therefore be to a large extent superficial.

The first edition of the present book appeared in 1906. Its purpose was to treat of the fundamental principles of nutrition. The introductory chapter, which occupies 53 pages, gives a concise and well-arranged historical statement of the development and results of nutritive studies. The succeeding chapters treat of the subject under well-chosen topics. The book is of value as a reference manual to students of nutrition. It is presented in readable form, so that it is also readily available to popular readers in whom the articles referred to above have awakened a somewhat superficial interest in the subject of nutrition. It is primarily intended, however, to encourage

more careful scientific study of the question, especially in hospitals.

Laboratory methods to explain the inner processes in disease have been applied to hospital patients for twenty years or more in Germany but in the United States little has been done in this regard. If such investigations are in any way promoted by their discussion here, this writing will not have been in vain.

In the second edition the scope of the book has not been changed, but advances that have been made during the past three years are included.

W. D. Bigelow

REPORT ON NEW ZEALAND SAND DUNES

The New Zealand Department of Lands has recently published a paper, by Dr. L. Cockayne, entitled "Report on the Sand Dunes of New Zealand" which treats of the geology and botany of the sand dunes and their economic bearing.

The first part of the article deals, in a general way, with the damage done by dunes, the objects of dune culture or reclamation and the description and acreage of the principal dune areas.

The dune question is attacked geologically in the second part of the paper. Here are discussed the origin of dune material; dune building, and the effects of various factors on the processes of dune formation and movement; and the various land forms of the dune area.

In treating the botanical features of the New Zealand dunes, in the third part, Dr. Cockayne sets forth the ecological factors governing their flora, and describes the most characteristic plants of the region and their "adaptations." He divides the plant life of the dunes into three groups, namely, sand binders, sand collectors and wet-ground plants. The methods of spreading of dune plants are also discussed. The subject of dune-plant associations is confined to dunes of western Wellington, though the author states that these may be taken as typical of those of the central floristic province of New Zealand. It is shown that each stage in the evolution of the dune possesses its characteristic plant association and also that "the plant-covering is an exact index of the wind force."

Among the important conclusions drawn by the author, the following may be mentioned:

It is useless to attempt artificial planting on many wandering dunes without shelter of the proper kind.

The neglect of wounds in the turf of stable dunes is perhaps the greatest source of danger to the adjacent fertile lands.

Under certain conditions a dune exposed to wind-tearing action may be naturally covered with shrubs and rendered stable without any previous preparation, except such shelter as is afforded by sand grass (*Spinifex hirsutus*).

In selecting shelter-plants for dune-afforestation purposes, tolerance of drifting sand is a matter of prime importance, without which drought or salt-resisting power are as nothing.

The paper is admirably illustrated by thirty-five excellent photographs and concludes with the citation of one hundred and thirteen works consulted in its preparation.

Charles S. Ridgway
Alabama Polytechnic Institute

SPECIAL ARTICLES

ON THE CONSERVATION OF HAILSTONES AND THE INVESTIGATION OF THEIR MICROSTRUCTURE

The investigation of microstructure of hailstones being till now very difficult if not impossible in summer, I constructed an apparatus (Fig. 1) for their conservation till winter-time. It consists of three coaxial cylinders; the inner space is intended for hail, the middle space for a mixture of ice and cupric sulfate (approximatively in proportion corresponding to eutectics, $t = -1°.6$), the outer space for ice, which forms a sort of guard-mantle.

During the summers 1908 and 1909 I had only once the chance of meeting a hail-storm —the 2/15 August, 1909, when I was at sea near Helsingfors on my way from Aland to St. Petersburg. This hail lasted from three to four minutes, the hailstones were very small

(2–3 mm. diameter), but still I gathered 200–300 gr. of them and immersed them—in order to prevent the freezing together—in glass boxes with a mixture of nearly equal parts of benzol and toluol which I presumed to be of a density equal to the density of hailstones, but which proved to be lighter. These hailstones I brought later to Tomsk (Siberia) and in December sent them to the Twelfth Congress of Russian Naturalists and Physicians in session at Moscow. These facts demonstrate thoroughly the possibility of conservation of hailstones. My experiment has also shown that it would be preferable to conserve one or two hundred hailstones separate from each other, than a greater number of them, partly frozen together (especially in lower layers). That can be attained by inserting hailstones in some very viscous liquid (cylinder oil, vaseline, castor oil) of a density only nearly equal to that of hail.

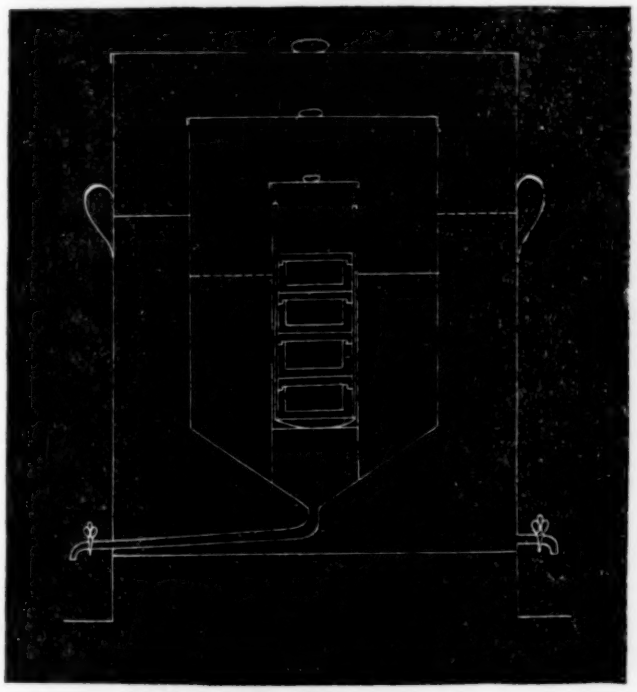

FIG. 1

For the investigation of the microstructure of a separate hailstone, Mr. W. Dudečki and I made a thin section of it by at first rubbing one side on emery-paper or by melting with the heat of a finger. This side was laid on an object-glass and frozen to it after touching during some time the other side of the glass with a finger; the other side of the hailstone was then polished in the same way as the first, till the requisite thickness was attained. These operations were so much easier, as the temperature of air was lower—below 0°. Still it was found possible to grind the hailstones in a room at the room-temperature, by means of cooling the object-glass, the emery-paper, etc., in double-walled vessels with mixture of ice and NaCl.

For the optical investigation of thin sections was used either a polarizing microscope

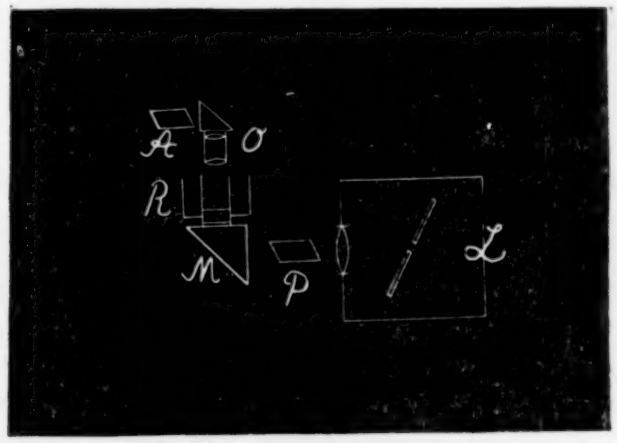

FIG. 2. *L*, projecting lantern; *P*, polarizator; *M*, mirror; *R*, refrigerating vessel; *O*, objective; *A*, analyzator.

or a projecting lantern *L* (Fig. 2). In this latter case the experiment was made in a lecture-room; the section was laid in a refrigerating vessel *R* with double walls and with double bottom (to prevent the condensation of the aqueous vapor from the surrounding air) of plane-parallel glass-plates; the space between the walls contained a mixture of ice and NaCl. The real image of section was projected on a screen or on a photographic ("autochrom") plate.

The major part of the hailstones were crystallic individuals, as also was the case with "artificial hailstones"—drops of water frozen in a mixture of cinnamon and linseed oil of suitable density. In those hailstones, which consisted of several crystallic individuals, there was no regularity in the boundaries between crystals in the angles between these bound-

aries, nor in the directions of the axes which lay indifferently to each other as well as to the milky nucleus which appeared in the section as a lot of air bubbles of different size.

I venture to hope that my attempt will call forth similar researches and would be glad if any other might have a chance to conserve or to study some bigger or more peculiar hailstones than I, and in this way improve our deficient notions about the origin of hail and the details of its formation.

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A SPECULATION IN CRYSTALLOGRAPHY

The conception of six systems of crystallization, which has been prevalent for nearly a century, has doubtless impressed many students of the subject as somewhat arbitrary. Especially does it appear so when it assumes four axes for the hexagonal system and only three for each of the others. To be sure, these axes are simply lines of reference, and the systems are ingeniously formulated so as to include all possible forms, which can be produced by the regular arrangement of particles having uniform size and similar shape in each particular case. While the scheme of classification is comprehensive and practical, it has really no more foundation in nature than the Linnean orders and families of plants.

The real misuse of these systems, however, has been when the crystallographic axes have been assumed to correspond to molecular bonds, or to similarly related axes in each molecule of a given substance, so that the molecules of a crystal are conceived to be arranged in straight lines corresponding to these axes. While this idea, which is often used in text-books, may be helpful in the explanation of crystals and of crystalline forms, yet it can readily be shown to be arbitrary and unnatural and therefore liable to mislead.

The purpose of this paper is to outline a more rational explanation of crystal structure, constancy of angles, cleavage and other physical properties.

If we should use globules of uniform size to represent molecules, or ultimate particles of an isometric substance, and allow them to take their most compact form, as they would by their mutual attraction, or under the influence of uniform external pressure, they would not arrange themselves in lines corresponding to rectangular axes, as is so often indicated in crystallographic diagrams and models. Instead of each one touching its neighbor at *six* points, as it would in that case, it touches at *twelve* points. Nature often shows a similar fact in the globular cells of organic tissues. When such are crowded together until the intervening spaces are obliterated, each cell takes the form of a *rhombic dodecahedron*.

We, therefore, take this form as a promising suggestion and look at it more carefully. We see that if we draw lines through the centers of opposite planes, or, if with globules compactly arranged, we draw lines through the centers of each and through opposite points of contact, each will be traversed by six lines, and if space be filled with such dodecahedrons, or with equal-sized globules, such space will be traversed with straight lines running in six directions. Every such line, or axis, will form an angle of 60° with four of the others and 90° with the sixth.

If space permitted, we might show that by assuming such an arrangement of isometric molecules all the different planes of that system may be as logically derived as they can be from the commonly postulated arrangement parallel with rectangular axes. Starting with a single molecule, if we should add successive layers of similar molecules equally in all directions, the result would be a rhombic dodecahedron. If the obtuse interfacial angles, eight in number, were modified by one plane, because of some variation of molecular attraction, or because of different density of the generating solution, octohedral planes would appear. If, on the other hand, the acute angles, of which there are six, should be similarly modified, we should have cubic planes, and so on through all the forms of the isometric system.

But, as we should naturally expect from the

very diverse chemical formulæ of different substances, we find many forms varying more or less from those of the isometric system. Nevertheless, so long as molecules are exactly similar to each other and are arranged in their most compact form, as they will be if given time to adjust themselves to their mutual attractions, each molecule will touch its neighbors at twelve points just as surely as in the case of the isometric, but the six lines passing through their points of contact will be no longer at the constant angles of 60° and 90°, but at varying angles. The angles between the lines in which the molecules are arranged in the mass will correspond strictly with the lines joining the points of contact in each molecule; hence we may limit our thought to a single molecule.

TABLE OF POSSIBLE DISTORTIONS OF THE RHOMBIC DODECAHEDRON AND RESULTING CRYSTALLOGRAPHIC SYSTEMS

Number of Modification.	Axes.		Corresponding System.	Planes Corresponding Nearly to Dodecahedral Planes.
	Constant.	Varying.		
1	6	0	I	Dodecahedron
2	5	1	O	Basal pinacoid Macro-pinacoid Pyramidal
3	4	2 equal, near 60°	M	Clino-pinacoid Clino-dome Prismatic Hemi-orthodome
4	4	2 equal, near 90°	T	Prismatic Pyramidal
5	4	2 unequal, near 90°	O	Macro-pinacoid Brachy-pinacoid Pyramidal
6	4	2 unequal, near 60°	Tri	Macro-pinacoid Macro-domes Prisms Hemi-brachydomes
7	3	3 equal, near 60°	H	Rhombohedral Prismatic
8	3	3 equal, near 60° and 90°	M	Basal Ortho-pinacoid Pyramidal
9	3	3 unequal, 1 and 2, 60° and 90°	M	Clino-pinacoid Clino-dome Prism Hemi-orthodome
9′	3	3 unequal, 1 and 2, 60° and 90°	Tri	Basal and macro-pinacoids Prisms and brachy-pinacoid Tetra-pyramid
10	3	3 unequal, 1 and 2, 60°	Tri	Basal and macro-pinacoids Brachy-domes and pinacoids Tetra-pyramid
11	3	3, all unequal, 60°	Tri	———
12	3	3, all unequal, 60° and 90°	Tri	———
(4)	2	4 equal, near 60°	T	As in 4
(3)	2	4 equal, near 60° and 90°	M	As in 3
(10)	2	4 unequal, 1 and 3, 60°	Tri	As in 10
(9)	2	4 unequal, 1 and 3, 60° and 90°	M or Tri	As in 9
13	2	4 unequal, 1, 1 and 2, 60°	M or Tri	———
14	2	4 unequal, 1, 1 and 2, 60° and 90°	Tri	———
15	2	4, all unequal	Tri	———
(2)	1	5, all equal	O	As in 2
(5 or 6)	1	5, 1 and 4	O or Tri	As in 5 or 6
(11 or 12)	1	5, 1, 1 and 3	Tri	As before
(15)	1	5, 1, 1, 1 and 2	Tri	As before
18	1	5, all unequal	Tri	———

If its form be that of a prolate spheroid with its poles equidistant from three of the axes, then those axes will be drawn as it were toward the poles and the lengths of these axes will be greater than of the other three. If the poles are midway between four of the axes, they will be similarly drawn together and elongated. If the molecule is an oblate spheroid, corresponding axes will be repelled and shortened. These cases will readily be seen to belong to the hexagonal, or rhombohedral, and the tetragonal systems; in the first two, with the vertical axis longer than the lateral, and in the last two, with the vertical shorter.

Some of the variations will not be regular or symmetrical, yet they may all be shown to correspond to some one of the six recognized crystallographic systems. The following table will indicate the possible variations and the systems into which they would fall, and also some other points. It is to be taken as suggestive rather than exhaustive.

Concerning hemihedral forms, we seem to obtain no more light from this conception than from the older view.

The apparent advantages resulting from this discussion may be briefly stated as follows:

1. It affords a rational explanation of the various phenomena and characteristics of crystals. Given equal and similar particles and simple attractions for each other, which attraction follows the laws conceived to govern gravitation, with the time and freedom for adjustment of particles in the most compact form, and crystals with constant angles and similar cleavage along similar planes, will necessarily result.

2. This recognition of the fundamental relation of the rhombic dodecahedron, which rests on mathematical principles, explains, also, why the kinds of symmetry found in crystals are only the two-, three-, four- and six-fold, for these are factors of twelve. We find why no five-, seven- or other fold will occur.

J. E. Todd

Lawrence, Kan.,
June 16, 1910

The Twenty-Second Annual Meeting of the Geological Society of America. II

The Upper Cayugan of Maryland: T. Poole Maynard, Atlanta, Ga. (Introduced by W. B. Clark.)

The Upper Cayugan of Maryland occurs in two well-defined areas in the western part of the state, the Hancock and Cumberland areas, and crosses the state in a northeast-southwest direction, following the general trend of the Appalachians. The rocks constituting the Upper Cayugan consist, usually, of argillaceous, thin-bedded limestones at the bottom, passing gradually into the heavier bedded limestones of the Lower Helderberg. These limestones lie between the Salina below and the Coeymans above and have an average thickness of one hundred and ten feet. There is only a gradual change in lithology from the Salina to the Coeymans and no well-defined lithological break exists. The upper and lower limits of the rocks constituting the Upper Cayugan are determined on paleontological grounds. These rocks, while equivalent in Maryland to the Manlius and Cobleskill of New York, can not be subdivided in Maryland on either paleontological or lithological grounds. The Rondout is absent in Maryland, while the fauna of the Cobleskill and Manlius are not distinct and separate as they are in New York, but they intermingle, typical New York Manlius and Cobleskill forms occurring together. They are also associated with forms occurring in the Upper Decker Ferry of New Jersey.

Discussed by A. W. Grabau.

Stratigraphic Relations of the Livingston Beds of Central Montana: R. W. Stone and W. R. Calvert, Washington, D. C. (Introduced by M. R. Campbell.)

The Livingston formation occurring at Livingston, Montana, has been described as resting unconformably on the Laramie and overlain by the Fort Union formation. Its age has been considered to be post-Laramie and it has been correlated with the Denver formation of Colorado, partly on lithologic similarity, both formations being composed largely of tufaceous beds. This paper showed that the Laramie of the Livingston and Little Belt Mountains folios of the Geologic Atlas of the United States is Eagle, or at least lower Montana, and that there is no unconformity between it and the overlying Livingston beds in the area under discussion. It showed also that on the west and south sides of the Crazy Mountains about 7,000 feet of sediments, mainly andesitic tuffs.

lying between the Eagle and Fort Union formations, constitute on lithologic grounds a single formation, but that on the north and east sides of the Crazy Mountains these same tufaceous beds are intercalated in the Colorado, Eagle, Claggett, Judith River, Bearpaw, "Laramie" and Fort Union formations. In other words, the Livingston has no formational value and has no definite age, for it represents volcanic activity which recurred throughout late Cretaceous and early Tertiary time.

Geologic Thermometry: FRED E. WRIGHT, Washington, D. C.

In ordinary thermometry, temperature is defined by the expansion of a perfect gas, and is expressed in terms of fixed units, determined by the freezing and boiling points of water under standard conditions. Temperatures are ascertained practically by means of thermometers which, although they differ greatly in type, are all based on some property which varies in a definite way with the temperature. In geology temperatures are of fundamental importance, particularly the temperature to which rocks were heated in past geologic ages and under inaccessible conditions. Points on the geologic thermometer scale must, therefore, be historical points, to be determined primarily by the permanent effects which such temperatures have produced on the rocks and rock components, and which are clearly marked even at lower temperatures. The factors which may serve to furnish points of this nature are, especially, melting temperatures of stable minerals and of eutectics, inversion temperatures of minerals, temperature limits beyond which monotropic forms can not exist under different conditions of pressure, also stability ranges of enantiotropic forms and of minerals which dissociate or decompose at higher temperatures, also temperatures beyond which certain optical or physical properties are changed permanently. These factors can be and are being determined by modern laboratory methods, and are in turn directly applicable to the study of rocks. The data now available on the geologic thermometer scale indicate that the establishment of such a scale is feasible, and can be accomplished by a sufficient number of proper laboratory determinations.

Discussed by J. F. Kemp, R. A. Daly, A. C. Lane and E. T. Wherry.

Some Mineral Relations from the Laboratory View-point: ARTHUR L. DAY, Washington, D. C. (Introduced by Fred E. Wright.)

The remarkable contributions which have been made to our knowledge of aqueous solutions since the formulation of the science of physical chemistry leave little doubt but that its generalizations can be applied with equal success to the study of rock formation. But the effort to make the application has brought us face to face with the fact that the problem of rock formation is of much broader scope and its phenomena are far more intricate than ever was imagined in the years when the first plans for laboratory work in the service of geology were made. This has had one conspicuous consequence. Most of the work done in the earlier years of laboratory experiment can not now be used to aid in the application of the new theories to mineral solutions. The first effect of this conclusion is to emphasize the necessity for widening our viewpoint to meet the increased scope which physical chemistry has imposed upon the study of mineral and rock formation from the magma, and the second, to compel us to revise our experimental methods so that the number of unknown factors will not outweigh the known and so prevent their intelligent interpretation and eventual application to geology. It is also necessary to recognize more explicitly the physical conditions affecting the problem upon its quantitative side. For example, we can not profitably continue to determine melting and solidifying points of natural minerals, and still less of complicated rocks, knowing that the addition of a small quantity of impurity almost always lowers a mineral melting point considerably, and knowing also that no mineral type occurring in nature is free from such impurities. We can not continue to observe melting temperatures by watching for the moment when the mineral begins to sag and run, knowing that in many most important minerals deformation does not occur until long after melting is over. We can not continue to ascribe individuality and characteristic properties to mineral glasses, knowing that they represent an unstable and undefined condition which may persist for months or years, or even for geologic time, without reaching equilibrium. At best, physical chemistry encounters this difficulty in considering both the natural minerals and the natural rocks—individual minerals do not occur in nature in uniform types, but are somewhat variable solid solutions with many minor ingredients; so too with the rocks we often find that equilibrium is not reached during the entire process of natural formation. It is difficult to

build a system of generalizations upon the properties of individuals which differ from their neighbors in any direction only in degree.

Discussed by A. C. Gill, Whitman Cross and the author.

Origin of the Alkaline Rocks: Reginald A. Daly, Boston, Mass.

Most alkaline-rock bodies are associated with subalkaline (lime-alkali) types. The magmas from which alkaline rocks have originated have usually been erupted through limestones or other carbonate-bearing sediments. The thesis was then presented that the majority of the alkaline rocks have been derived from subalkaline (generally basaltic) magma through the absorption of limestone or dolomite by the magma. The solution of a relatively small proportion of the carbonate disturbs the chemical equilibrium of the subalkaline magma and its alkalies are concentrated in (generally the upper) part of the magma-chamber. According to conditions the concentration of the alkalies will vary in amount. The hypothesis explains the field associations, and the mineralogical and chemical compositions of most alkaline rocks.

Discussed by J. F. Kemp, Whitman Cross, H. P. Cushing, A. E. Barlow, W. G. Miller and the author.

The Complex of Alkaline Igneous Rocks at Cuttingsville, Vermont: J. W. Eggleston, Cambridge, Mass. (Introduced by J. E. Wolff.)

This is an oval area of alkaline igneous rocks, stock-like, with roughly concentric arrangement, and intrusive into gneisses. Syenite, with nepheline-bearing varieties is the chief type. There is also much essexite. The mass is cut by numerous dikes, including tinguaite and camptonite. In chemical character the rocks are closely related to those of southern Norway, described by Brögger.

Discussed by J. E. Wolff, F. E. Wright and J. A. Dresser.

Obsidian from Hrafntinnuhryggur, Iceland: Fred E. Wright, Washington, D. C.

The paper described (*a*) peculiarly pitted surfaces on specimens of obsidian which resemble in a remarkable degree the markings of the Austrian moldavites; (*b*) also a unique type of crystallization in cavities in this obsidian.

Bleaching of Granite at Limestone Contacts: H. P. Cushing, Cleveland, O.

In the Thousand Island region the red granite gneiss of Laurentian age invariably becomes white at limestone contacts and all the granitic dikes in the Grenville limestone are white. The color change does not take place, however, at the contacts with other Grenville sediments, either schists or quartzites, and the dikes in these rocks are red. Both the cause of the color change and the influence of the limestone in producing it are uncertain.

Pegmatite in the Granite of Quincy, Mass.: C. H. Warren and C. Palache, Boston and Cambridge, Mass.

Only two important occurrences of pegmatite are known in the riebeckite granite of Quincy. These are exposed in two of the quarries and take the form of rudely cylindrical masses of considerable size entirely enclosed in the granite. In mineral composition they are closely similar to the granite, the essential minerals being quartz, alkali-feldspar, riebeckite and ægirine-augite; accessory minerals so far identified are fluorite, parisite, octahedrite, ilmenite, wulfenite and the sulphides molybdenite, galena, sphalerite and chalcopyrite. The pegmatites exhibit a certain symmetry of structure. Fine graphic-granite forms a marginal band, succeeded centrally by a zone of coarse granitic texture made up of quartz, feldspar, riebeckite and ægirine-augite. As a rule this zone graduates centrally into almost pure massive quartz, sometimes containing sulphides. In one portion of the largest mass the center is miarolitic and in the cavities thus formed the quartz, feldspar and ægirine-augite are well crystallized, while the rare minerals, noted above, find their principal development. Angular fragments of the pegmatite enclosed in felted crocidolite and deeply corroded crystals of riebeckite partly replaced by fluorite, point to a final stage of crushing and pneumatolytic action. The paper described these deposits and the minerals in detail.

Remarks were made by J. F. Kemp.

Fayalite in the Granite of Rockport, Mass.: Charles Palache, Cambridge, Mass.

A recent discovery of large crystals of fayalite in a granite pegmatite near Rockport furnishes for the first time opportunity for an accurate description of this interesting mineral occurrence, the mineral having been twice before found here, but in neither case studied in place.

Microscopic Study of Certain Coals in Relation to the Sapropelic Hypothesis: E. C. Jeffrey, Cambridge, Mass. (Introduced by David White.)

Discussed the ingredient matter and relation of the same to formation of cannels, kerosene

shales, bogheads, etc. Evidence against algal hypothesis as accounting for special characters.

Remarks by David White.

The Regional Devolatilization of Coal: DAVID WHITE, Washington, D. C.

Regional progressive devolatilization, which marks the second (dynamo-chemical) stage of coal formation, is due in most areas to deep-seated horizontal thrust pressure long continued. Essentially it is regional metamorphism, coal being a most sensitive index. Effects of loading and faulting. Comparison of effects of intrusives.

Discussed by J. F. Kemp.

Present and Future of Natural Gas Fields in the Northern Appalachians: F. G. CLAPP, Pittsburgh, Pa.

The waning natural-gas supply in some fields brings up the question as to the future of the natural-gas business. We must admit that the outlook is in some ways discouraging, but nevertheless the predominant indications are that new wells and new fields will continue to be found and to be productive for many years yet. During the past year there has been improvement and increase in the business and in the area of the productive fields in Pennsylvania and West Virginia. That the companies are not discouraged is evidenced by the fact that during 1909 the mains of the principal producers have been greatly extended. Cincinnati is now supplied, with every prospect that in another year Baltimore, Altoona and possibly Washington will have natural-gas mains. This paper described several new fields of interest, and their relation to the geological structure is summarized. Most of the shallow sand fields exhausted years ago have been recently replaced by adjacent new fields in deeper sands. In all cases yet examined by the writer, these fields bear a constant relation geologically to each other and to the structure.

Discussed by J. F. Kemp and F. R. Van Horn.

The following papers were presented by title:

Tide Water Glaciers of Prince William Sound and Kenai Peninsula, Alaska: U. S. GRANT, Evanston, Ill.

Eolation Under the Stimulus of Aridity: CHARLES R. KEYES, Des Moines, Iowa.

Glacial Lakes and Channels near Syracuse: T. C. HOPKINS, Syracuse, N. Y.

Glacial Investigations in the Lake Superior Region in 1909: FRANK LEVERETT, Ann Arbor, Mich.

Coon Butte; and Meteoritic Falls of the Desert: CHARLES R. KEYES, Des Moines, Iowa.

Bird's Hill, an Esker near Winnipeg, Manitoba: WARREN UPHAM, St. Paul, Minn.

The Red Sandstones of Southeastern Minnesota: C. W. HALL, Minneapolis, Minn.

The Magothy Formation of the Atlantic Coast: A. B. BIBBINS, Baltimore, Md.

Discovery of Fossils in the Quantico Slate Belt, and the Association of Volcano-sedimentary Beds with the Slates of the Virginia Crystalline Region: THOMAS L. WATSON, University of Virginia, and S. L. POWELL, Salem, Virginia.

Pleistocene Phenomena of Central Massachusetts: W. C. ALDEN, Washington, D. C.

Revision of Paleozoic Systems, II.: E. O. ULRICH, Washington, D. C.

Evidence that the Fossiliferous Gravel and Sand Beds of Iowa and Nebraska are Aftonian: B. SHIMEK, Iowa City, Iowa.

Note on a Method in Teaching Optical Mineralogy: F. W. MCNAIR. (Introduced by A. C. Lane.)

Pebbles: Types Formed by the Sea, Rivers, Wind and Glaciers: F. P. GULLIVER, Norwich, Conn.

Rhode Island Coal: CHARLES W. BROWN, Providence, R. I.

Preglacial Drainage of Central Western New York: A. W. GRABAU, New York, N. Y.

The Barite Deposits of Five Islands, N. S.: CHARLES H. WARREN, Boston, Mass.

Nelsonite, a New Rock-type: Its Occurrence, Association and Composition: THOMAS L. WATSON and STEPHEN TABER, University of Virginia.

The following officers were elected for 1910:

President—Arnold Hague, Washington, D. C.

First Vice-President—Charles Schuchert, New Haven, Conn.

Second Vice-President—A. P. Low, Ottawa, Canada.

Secretary—Edmund Otis Hovey, New York, N. Y.

Treasurer—William Bullock Clark, Baltimore, Md.

Editor—J. Stanley-Brown, Cold Spring Harbor, N. Y.

Librarian—H. P. Cushing, Cleveland, Ohio.

Councillors (1910–12)—J. B. Woodworth, Cambridge, Mass., and C. S. Prosser, Columbus, Ohio.

Fellows elected December 28, 1909—William Clinton Alden, Wallace Walter Atwood, Edson Sunderland Bastin, Edward Wilber Berry, Willis Stanley Blatchley, Henry Andrew Buehler, Fred Harvey Hall Calhoun, Arthur Louis Day, Frank Walbridge De Wolf, James Walter Goldthwait,

Baird Halberstadt, Oscar H. Hershey, Frederick Brewster Loomis, Richard Swann Lull, George Rogers Mansfield, Lawrence Martin, Samuel Washington McCallie, William John Miller, Malcolm John Munn, Edward Orton, Jr., Philip S. Smith, Warren Du Pré Smith, Cyrus Fisher Tolman, Jr., Charles Will Wright.

Correspondents elected December 28, 1909—Professor Charles Barrois, Lille, France; Professor W. C. Brögger, Christiania, Norway; Sir Archibald Geikie, Haslemere, England; Professor Albert Heim, Zürich, Switzerland; Professor Emanuel Kayser, Marburg, Germany; Professor Eduard Suess, Vienna, Austria; Professor Ferdinand Zirkel, Bonn, Germany.

The secretary announced the death during the past year of Persifor Frazer and Daniel W. Langton.

The report of the committee on the formation of the Paleontological Society was presented through its chairman, W. B. Clark, as follows:

"On February 13, 1909, at the American Museum of Natural History, New York City, your committee, composed of W. B. Clark, chairman, and Messrs. H. E. Gregory, J. M. Clarke and E. O. Hovey, C. W. Hayes being absent, met the organization committee of the Paleontological Society, consisting of Charles Schuchert, chairman, and Messrs. F. B. Loomis, David White and T. W. Stanton. Messrs. S. W. Williston and H. F. Osborn, of the Paleontological Society, were absent. The conferees went over the proposed constitution of the new society article by article, and finally adopted it in the form which was distributed to the fellows of the society in March, 1909.

"As organized, the Paleontological Society is a section of the Geological Society of America, in accordance with the expressed wish of the majority of paleontologists of the country, and only fellows of the Geological Society of America are eligible to fellowship in the Paleontological Society. Fellows of the Geological Society whose work is primarily in paleontology may become fellows of the Paleontological Society, on application to the council of the latter, without further payment of dues. Persons not fellows of the Geological Society who are engaged or interested in paleontological work may become members of the Paleontological Society by vote of the society on nomination by two fellows and approved by the council."

The council recommended the adoption of the following preamble and resolutions submitted by the American Philosophical Society:

"Whereas the United States in former years did much to increase our knowledge of the Antarctic regions, by means of the expedition of Lieutenant Charles Wilkes, U.S.N., and the voyages of American whalers, and

"Whereas there has been a great revival of interest in recent years in the South Polar regions, resulting in the despatching of scientific expeditions to explore portions of this area by England, Belgium, Sweden, Germany and France, and

"Whereas large areas in the far south will remain unexplored and many branches of science would be benefited by the sending of an American expedition to the far south, having for its object the reexploration of Wilkes Land and the collection of scientific data relating to regions visited, therefore be it

"*Resolved* that the Geological Society of America respectfully urges the federal government to consider the desirability of appropriating funds for the purpose of fitting out a suitable vessel, under the direction of the Secretary of the Navy, to undertake such exploration."

The first annual meeting of the Paleontological Society, organized under the arrangement noticed above, was held at Cambridge, Mass., December 29 and 30, 1909, and the following program was presented:

After the presidential address had been delivered by Dr. John M. Clarke, a "Conference on the Aspects of Paleontology" was held, at which papers on assigned topics were read by members of the Society by invitation of the council, as follows:

Adequacy of the Paleontologic Record: R. S. Bassler.

Interdependence of Stratigraphy and Paleontology: W. J. Sinclair and E. O. Ulrich.

Biologic Principles of Paleogeography: Charles Schuchert.

Paleontologic Evidences of Climate: T. W. Stanton and David White.

Migration: Henry S. Williams and Arthur Hollick.

Paleontologic Evidences of Adaptive Radiation: H. Fairfield Osborn.

Anatomy and Physiology in Extinct Organisms: Charles R. Eastman and Rudolph Ruedemann.

Contributions to Morphology from Paleontology: William Bullock Clark.

Embryology and Paleontology: Richard S. Lull and William H. Dall.

Ontogeny and Paleontology: F. B. LOOMIS and AMADEUS W. GRABAU.

Phylogeny and Paleontology: ROBERT T. JACKSON and D. P. PENHALLOW.

Paleontologic Evidences of Recapitulation: E. R. CUMINGS and L. HUSSAKOF.

Isolation in Paleontology: JOHN M. CLARKE.

Continuity of Development from the Paleontologic Standpoint: T. WAYLAND VAUGHAN.

Paleontology of Man: S. W. WILLISTON.

Varanosaurus Species: a Permian Pelycosaur: S. W. WILLISTON, Chicago, Ill.

Description with full illustrations of the complete skeleton of *Varanosaurus* sp., a primitive pelycosaur from the Permian of Texas; a slender crawling reptile, four feet in length. The specimens upon which the description is based were found almost perfectly preserved in a remarkable bone-bed associated with dozens of others of the same and related forms.

Discussed by H. F. Osborn, W. J. Sinclair and W. J. Holland.

The Structure of the Sauropod Dinosaurs: with special reference to the recent mounting of the skeleton of *Diplodocus carnegiei* Hatcher: W. J. HOLLAND, Pittsburgh, Pa.

This paper discussed certain recent criticisms of the work of Professors Marsh, Osborn, Lull, Hatcher and the writer in connection with the osteology of the sauropod dinosaurs.

Discussed by S. W. Williston.

Phylogenetic Position of the Genus Stegomylus: F. B. LOOMIS, Amherst, Mass.

The Armor of Stegosaurus: R. S. LULL, New Haven, Conn.

Discussed by H. F. Osborn and W. J. Holland.

Restoration of Paleolithic Man: R. S. LULL, New Haven, Conn.

New Genus of Permian Reptile: S. W. WILLISTON, Chicago, Ill.

Principal Character of the Chelydrosauria, a Suborder of Temnospondyte Amphibians from the Texas Permian: S. W. WILLISTON, Chicago, Ill.

Skull of Tyrannosaurus: H. F. OSBORN, New York, N. Y.

Anderson's Methods of Photography in Vertebrate Paleontology: H. F. OSBORN, New York, N. Y.

Correlation of the Pleistocene of Europe and America: H. F. OSBORN, New York, N. Y.

Permian Floras in the Western "Red Beds": DAVID WHITE, Washington, D. C.

Characteristic floras, found in a brief tentative search of red beds at three points in Colorado and New Mexico, not only prove Permian age but also indicate great thickness of Dyas in certain "Red Beds" sections in the Rocky Mountains. Examination of lower middle Wichita in Texas and additional collections from Chase (Wreford and Winfield beds) and Wellington of Kansas and from red beds within the same limits in Oklahoma, confirm lower Permian correlations.

Discussed by C. Schuchert, J. W. Beede, J. M. Clarke and E. O. Ulrich.

The Ordovicic-Silurio Section of the Mingan and Anticosti Islands, Gulf of St. Lawrence: CHARLES SCHUCHERT and W. T. TWENHOFEL, New Haven, Conn.

The section is a large one, beginning on the Mingan Islands in the lower Ordovicic and continued on Anticosti, where there is a complete transition from the Richmondian into the Clinton. The succession was described and correlations made with standard sections in the United States.

Discussed by E. O. Ulrich and A. W. Grabau.

On the Persistence of Fluctuating Variations, as Illustrated by the Genus Rhipidomella: HENRY S. WILLIAMS, Ithaca, N. Y.

A summary was given of results obtained from a comparison of measurements of a series of specimens of the brachiopod *Rhipidomella* from the Hamilton formation and from successive zones of recurrent Hamilton faunas in the upper Devonian of central New York, representing, probably, over a million years of the history of the genus; to which were added some remarks upon the bearing of the facts on the nature of organic variations.

Intracolonial Acceleration and Retardation, and its Bearing on Species: AMADEUS W. GRABAU, New York City.

Acceleration or tachygenesis and retardation, or bradygenesis, operate in differentiation of species by affecting either the entire individual (genepistasis), or only certain organs (heterepistasis), using these terms in a somewhat modified sense. These principles are applicable wherever it can be shown that development is orthogenetic. Intracolonial acceleration and retardation affect individuals within the colony so that they will either become more specialized in one or more determinable directions, or will remain in a more primitive stage of development than other members of the colony. Thus the colony will come to consist of individuals representing distinctly different steps in an orthogenetic series, *i. e.*, it will be multispecific. Examples from the invertebrates and from plants were cited.

The Fauna of the Girardeau Limestone and of the Edgewood Formation: T. E. Savage, Urbana, Ill.

The Girardeau limestone is exposed over a small area in the southwestern part of Illinois and adjacent portions of Missouri. It consists of thin-bedded, fine-grained, dark-colored limestone, having a maximum thickness of thirty-five feet. The Edgewood formation rests unconformably upon the eroded surface of the Girardeau limestone. It outcrops in Illinois along the Mississippi River, north of the town of Thebes, where it has a total thickness of about thirteen feet. It is composed of a limestone conglomerate at the base, which is succeeded by a few feet of alternating shale and limestone layers followed by massive, coarse-grained limestone at the top. Twenty-seven species of fossils found in the Girardeau limestone and twenty-two species collected from the Edgewood formation are recorded. Ten of these are new. In these faunas are genera considered characteristic of the Silurian. Since the formations underlie strata in this region which correspond with the Clinton beds of Indiana and Ohio, they are referred to a position at the base of the Silurian, below the horizon of the Clinton.

The Phylogeny of Certain Cerithiidæ: Elvira Wood, Waltham, Mass.

In order to determine the proper application of the term *Cerithium*, a genotype must be selected as a starting point. The ontogeny of this type gives a clue to the history of the phylum. By a comparison of ontogeny in recent and fossil forms the phylogeny of the group is worked out. By employing these standards *Cerithium* as now in use is shown to be a polyphyletic genus. With either *Cerithium nodulosum* or *C. tuberosum* as genotype a large number of species now classed with *Cerithium* may still be retained in that genus, and as thus restricted *Cerithium* becomes a monophyletic genus.

Mode of Life of the Eurypterida: John M. Clarke and Rudolf Ruedemann, Albany, N. Y.

Deduced the life habits of these creatures from their anatomy and mode of occurrence.

A new Cystid from the Clinton Formation of Ontario: W. A. Parks, Toronto, Canada.

In Vol. I. of the "Paleontology of Ohio" Meek describes *Lepocrinites moorei*. This form differs from all other cystids in having pectinirhombs on plates 15 and 10 in addition to the ordinary ones. Carpenter, Jaekel and Bather consider this feature of generic value. The priority of generic names rests with Carpenter (*Lepadocystis*). The new species described as *Lepadocystis clintonensis* differs in minor details only from the genotype. As Meek's description was based on a single specimen, we have in the present form the second specimen of the genus ever found, and also the type of a new species.

Some New Fossils from the Cambrian of South Attleboro, Mass.: W. B. Hall. (Introduced by R. S. Lull.)

Notes on the Upper Carboniferous in Southeastern New Mexico and Western Texas: G. B. Richardson, Washington, D. C.

A number of sections were described and correlated. It was shown that the Upper Carboniferous in southeastern New Mexico and western Texas consists of a variable sequence of strata which are delimited above and below by major unconformities. The stratigraphic position of the disputed "Guadalupian" beds was also shown.

The Correlation of the Guadalupian and Kansas Sections: J. W. Beede, Bloomington, Ind.

The Guadalupian limestones of western Texas and southern New Mexico are overlain by the Pecos Valley Redbeds. These beds present the same lithologic features and are of similar succession as the Redbeds on the eastern side of the Llano Estacado and carry a fauna closely related to them. The gypsums appear to be the equivalents of the Greer gypsums as exposed in Oklahoma and Texas. If this correlation is correct, then the base of the Capitan limestone is on the same stratigraphic level, approximately, as the base of the Elmdale formation of Kansas and the base of the Guadalupian series on the level of the base of the Cherokee shales. The five thousand feet of Hueco beds would fall below this level.

The election of the following officers for the year 1910 was announced:

President—Charles Schuchert, New Haven, Conn.

First Vice-President—E. O. Ulrich, Washington, D. C.

Second Vice-President—S. W. Williston, Chicago, Ill.

Third Vice-President—F. H. Knowlton, Washington, D. C.

Secretary—Ray Smith Bassler.

Treasurer—W. D. Matthew, New York, N. Y.

Editor—Charles R. Eastman, Cambridge, Mass.

The next meeting of the Geological Society will be held at the Carnegie Museum, Pittsburgh, beginning Tuesday, December 27, 1910.

Edmund Otis Hovey,
Secretary